Design Ideation Method Adaptation for Creative Thinking in the Technology Industry

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Abstract: Sudden changes in technology require companies to have a workforce that can continually create innovative high concept products and services. Companies that rely on their technology divisions to drive innovation require their engineers to have creative design abilities as well technical prowess. The reliance on engineers with these dual skill sets does not guarantee success and often results in failure due to restrictively systematic methodologies that stifle creativity, engineering monocultures, and the assumption that technology is a specialists' field. Design driven companies, on the other hand, often lack a concrete methodology that can be applied to other companies due to a lack of knowledge of the definition of what design is and the ineffective conversion of employees into creative design forces. Therefore, this paper suggests to introduce a solution that can increase creativity within the technology centers of the world by analyzing both technology and design driven methodologies, combining the methodologies in conjunction with environments that foster learning through doing as seen in the Do It Yourself (D. I. Y.) technology movement.

Key words: creative concept, D. I. Y., engineering, technology, design thinking, methodology

1. Introduction

1-1. Research Background

Changes in technology change companies' life cycles and causes deviations and breaks within established market trajectories. New technology and products represent the new S-Curve[1] that drives the market. This curve also has deviations and breaks due to new competitors flowing into the market and innovations from technology divisions within existing companies that results in the formation of a new S-Curve. This new curve directly challenges all existing entities within the market and therefore new companies and technology divisions are seen as their largest threats. Therefore, companies must continually produce new value to stay competitive. As a result widespread management practices have been reformed to emphasize creativity and innovation through the adoption of education based on TRIZ[2], ASIT[3], the teaching of creative concept methodology, as well as

1 S-Curves are a phenomenon showing the typical path of product performance in relation to investment in R&D. The method was introduced as a result of several studies on technologies and firms performances.
2 TRIZ means "The theory of inventor's problem solving". It was developed by Soviet engineer and researcher Genrich Altshuller and his colleagues in 1946. TRIZ is a methodology, tool set, knowledge base, and model-based technology for generating innovative ideas and solutions for problem solving. TRIZ provides tools and methods for use in problem formulation, system analysis, failure analysis, and patterns of system evolution (both 'as-is' and 'could be').

successful benchmarking of the creative leadership such as seen in the Dubai case. The rate of revenue and growth seen after implementing these education and methodologies to boost innovation has been less than 10% to no change at all. Therefore, it will be awhile until creative concept methodologies and thinking techniques take firm root. [1, 2]

1-2. Research Methods

The research looks directly at the troubles and demands of using creative concept methodologies within companies. By comparing design and technology driven methodologies, I will look to generate a solution to overcome the shortcomings of both approaches that will result in facilitating the creative process within corporate environments.

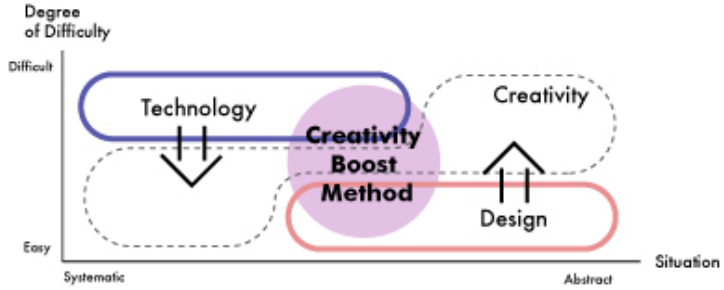


Figure.1 Design and Technology Approach Methodology for Creative Concepts

2. Problems

2.1 Technology Aspect

In the past, competition in the technology industry was driven by capacity, performance, quality, and value; however, this has shifted to favor high concept design recently. Enterprises focused on sense and concept (high concept) have more competitive power than enterprises focused on technology and service (low concept) in creating value.[3, 4] High concept designs are inherently difficult to produce since they require creativity and a strong conceptual basis for success. When developing a high concept product or service, a lack of creativity can result in the failure to produce a product. The reason for this is that there is not enough cross-pollination between the creative minds and technological innovators. This problem stems from the pressure to generate new products and services, which results in technology continuing to be a specialist's domain, the adherence to concrete and systematic methodologies that impede creativity, and high overhead in the way of time and resources.

The perception that technology is hard to understand and become acquainted with results in engineers and experts being the driving force behind new technology-based ideas. Companies that rely on engineers, with a single skill set, have structures that inhibit employees from different divisions from fielding their own ideas. Additionally, there is no critical analysis of ideas generated of engineers or technology divisions since other divisions often feel pressured to uphold the status quo of the engineer as the expert. As a result, potentially useful voices fall into the passive role of the team player and are underutilized.

3 ASIT means "Advanced Systematic Inventive Thinking)". It is a unique approach to problem solving. Based upon a Russian method called TRIZ. It provides a step-by-step process to help you analyze problems and find solutions. ASIT uses the patterns found in hundreds of creative solutions that were examined and compared.

Many companies prefer concrete and systematic methodologies to create ideas, but these methodologies have limits to their useful application as creative concept methodologies. A widely accepted creative concept methodology among large enterprises is TRIZ. TRIZ is a highly effective methodology for solving electrical and chemical engineering problems, but other divisions have found TRIZ hard to learn and to apply. TRIZ is a widely used concept methodology in SIT and other divisions because the solutions that TRIZ has to offer are concrete and systematic. Other divisions looking for a creative concept methodology will often adopt a methodology regardless of its actual usefulness for their specific application since those around them are using it.

Technology centered creative concept methodologies require large amounts of time and resources to create a result due to time spent on technical feasibility and training engineers to adopt creative concept methodologies. This directly hinders the creation of new enterprise. Professor David A. Garvin, from the Harvard Graduate School of Business Administration, states that it takes about 7 years for a new enterprise to become a "Cash Cow." This period gets shorter every minute along with the life cycle in the technology industry. However, even if new enterprises generate new ideas, companies are still focused on technology and investment profits. Companies still use copious amounts of resources and time to choose an idea. Open innovation development environments aim overcome this hurdle by creating idea simulations or prototypes that reduce the time needed to materialize business.

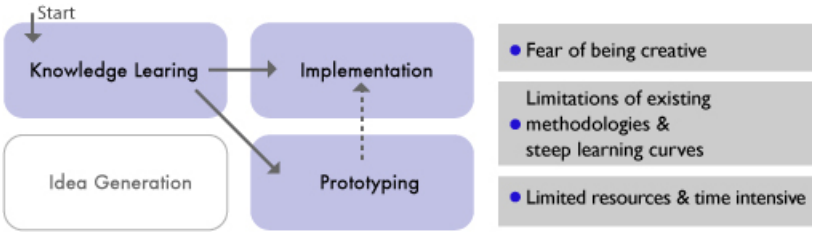


Figure.2 Problems in Technology Based Concept Processes

2.2 Design Aspect

Business administration has been heavily influenced by Daniel Pink's proposition of the competent right brained creative individual from his book, *A Whole New Mind*. [5] Despite this effort to include creative minds, there still are problems that continue to inhibit progress. Most of these problems stem from preconceived notions about design methods by technology divisions. The problem begins with having a flawed understanding of "design." Design as a noun means, the way in which something has been planned and made. The verb form means, "To investigate problems or causes and relate and materialize and give solution to designing."[6] However, management within enterprises normally think of "design" as a noun and rarely as a verb. Normally the design concept is seen as a means to make quality improvements, which means design methodology is not even applied at the conceptual stage of an idea. As a result, enterprises think that design concept methodology is simply used to produce fancy products. The mindset of business management must be changed to view design as a verb and as a legitimate creative concept methodology.

As the technology division emphasizes user experience human focused design concept methodology has begun to gather strength. Tim Brown, from IDEO, claimed that Design Thinking is the foundation of innovation. According to Brown, Design Thinking meets the consumer's demand by using a sense of design and

methodology while turning the market opportunity and consumer value into a business strategy. [8] From a general point of view, this means that extending the concept of design will increase an organization's creativity, and this will lead to the reinvention of enterprises. However, detailed information about how the sense of a designer and design methodology can lead to innovation is not explained in detail. Design Thinking as a result is tied more directly to IDEO's accumulation of experience as a company. As a result, other enterprises have had difficulty applying Design Thinking to yield innovative products.

To apply Design Thinking methodology, enterprises need to hire "T-shaped people" or expand the design field.[7] However, 90% of the company personnel have rigid characteristics and 10% of creative characteristics, in some cases these percentages are inverted. There are different points of view about whether having creative employees or having adequate resources and processes is more efficient. In addition, it is difficult to find a creative person, and there is no guarantee that this person will think creatively within the given environment. Therefore, rather than depending on creativity, most enterprises educate and motivate exisiting personnel. From the enterprise's vantage point, they want existing human resources to change and conform, through education, to fill the creative needs of the enterprise. Currently, teaching Design Thinking or changing existing resources is not proving to be any more effective than hiring T-shaped people.

The technology centered thinking process focuses on acquisition of knowledge and technique, and the application of knowledge and technique to materialize an idea. Creating ideas is vulnerable to the demands and expectation of the consumer and the market, which is why people from other divisions should be asked to join and express their ideas in order to boost creative thinking amongst engineers and professional technicians.

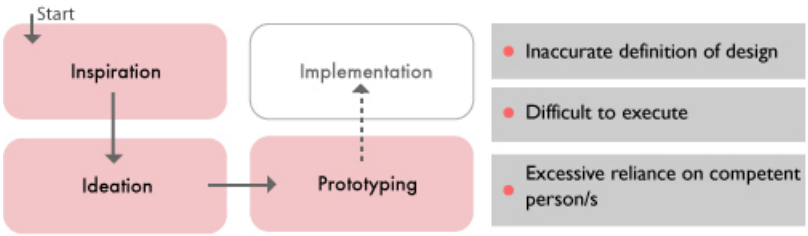


Figure.3 Problems in Design Centered Concept Processes

Design Thinking relies on people having various inspirations, and on intuitive thinking based on experience to develop the resulting idea into a prototype. This methodology had not been received well by businesses primarily due to the lack of understanding of design, proper guidelines, and the intuitive nature of Design Thinking that runs in opposition to the systematic approaches that businesses typically seek.

3. Solutions

As previously stated, in this solution I would like to propose an ideal way to remove the elements that are considered problems with the technology centered concept and the design centered concept. Moreover by looking through given proposals from individual divisions, I would like to present an ideal concept methodology direction in which two divisions are combined.

3.1 Solutions for Technology Concept Methodologies: Participation & Sharing

Fear, high learning curves, limitations of established methodologies and time are the problems in the Technology

Centered Creative Concept. Recently, there are trends and movements to overcome these weak points with the prime example being the Do It Yourself (D.I.Y.) technology movement. As technology rapidly spreads, techniques shared only by a few in the past are now transformed into educational programs so that anybody can learn them easily. D. I. Y. started with the Internet boom and was primarily situated as an art movement, but it has expanded to include technology and has shown how to mitigate the steep learning curves that often come with technology. D. I. Y. artists, designers, and developers participate and share their open source software and hardware on community websites. Through participation and sharing, it is possible to move away from limited concepts and to derive new senses and fresh concepts.

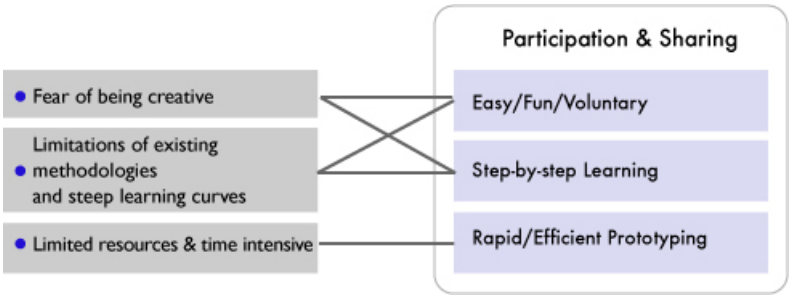


Figure.4 Solutions to the Problems of Technology Centered Concept Processes

- **Instructables.com Community Website**

Instructables.com is a free website that provides documentation about how to make various items, with its driving force being participation and sharing. This community started from www.zeroprestige.org where Saul Griffith, Eric Wilhelm and other colleagues sought to document a how-to project about kites that resulted in thousands of ideas and plans which were subsequently shared. Based on this experience they launched www.Instructables.com in late 2004; it was a combination of open source and hardware hacking sometimes called iFabricate. Currently, Instructable.com provides a range of content that is not limited to technology but to other areas as well, which in turn generates new ideas.

- **Make: Magazine**

Make Magazine, published by O'Reilly Media, is another example of participation and sharing. It facilitated the boom of DIY technology trends within the United States that in turn broadened the target audience to include the general public. It is one of O'Reilly's bestsellers with a large readership in America. The Make Magazine website contains blogs, podcasts, forums, etc., that include technical advice on computers, electrical machinery and appliances, robotics, metal work and wood works. Make Magazine also puts on the Maker Fair, a biannual showcase of D.I.Y. technology. Thousands of inventors and artists exhibit their inventions. The fair provides a place where ideas and invention information are freely shared.

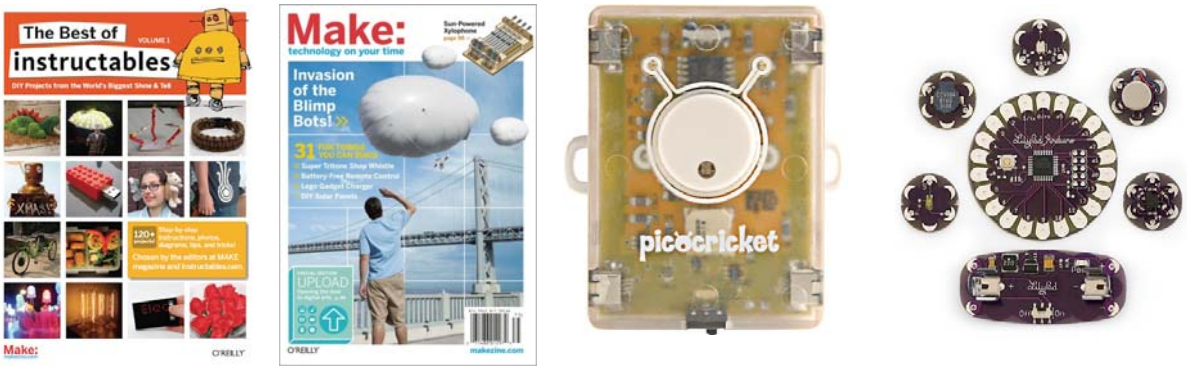
- **PicoCricket kits and Scratch software**

PicoCricket and Scratch were developed by the MIT Media Lab project group for Lifelong Kindergarten, led by Professor Mitch Resnic. PicoCricket is somewhat similar to LEGO Mind Storm, but it has a larger range of electrical sensors that allow a child to make different projects with a wide variety of materials, not just LEGO blocks. The PicoCricket kit has an infrared communication device that is used to communicate with the desktop computer. Light, sound, touch, and electric resistance sensors can be connected as input devices and motors,

LED bulbs, speakers, digital display etc. can be connected as output devices. PicoCricket also includes its own software for easy development. Scratch is like the PicoCricket; however, it can be used to generate online multimedia work, and is similar to a Adobe Flash. Both Pico Cricket and Scratch use very complicated technology; however, they succeed in making it easy for anyone who wants to learn the basics, and even advanced projects can be carried out if one is motivated.

- **E-Textile kit and LilyPad Arduino**

Leah Buechly has been working on a self-educating project using an e-textile kit that she developed to teach middle and high school children about wearable computing. Early versions of the e-textile kit were embedded in fabrics but the kit was later introduced as PCB board versions by Sparkfun as LilyPad Arduino to reduce user errors. Both the e-textile kit and LilyPad Arduino were created with wearable computing in mind. They were developed in the smallest possible size in which people could use conductive threads to connect to sensor modules and create their very own devices. These kits can be used to create a range of products, from "low technology" projects like needlework to "high technology" industrial art pieces. It is based on the DIY workshop and is currently leading the democratization of technology.



Instructables.com Make: magazine PicoCricket LilyPad Arduino

Figure.5 Solutions for Technology Concept Methodologies

3.2 Solutions for Design Centered Concept Methodologies: Practicality & Concreteness

Since management divisions have realized the importance of Design Thinking and have attempted to apply sense and design centered concept methodologies, they have struggled with the lack of concreteness of these methodologies. However, the previously nonsystematic design centered concept methodologies have begun to be organized into practical and concrete processes and methodologies, but many still lack the requirements demanded by businesses.

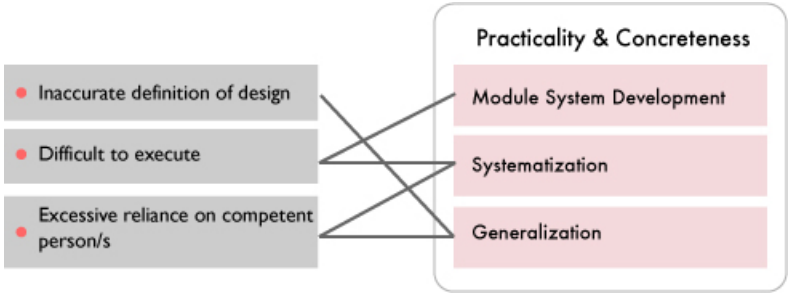


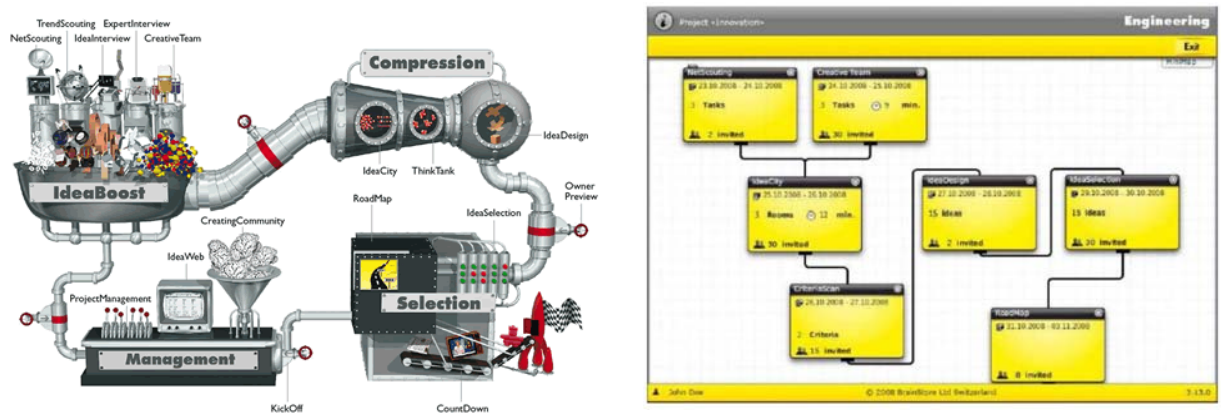
Figure. 6 Solutions to the Problems in Design Centered Concept Processes

- **IDEO process**

IDEO's process relies on using the subject's point of view and observations as a starting point, which provides Insights that make us think of an idea that is proven to be effective. [9,10] Brain-storming known as the Deep Dive Method have been recognized as a highly effective way to state many ideas. However, it is still not appropriate to apply this method into enterprises as a methodology because it lacks vital details. After a 2006 visit by IDEO, one of Korea's biggest telecommunication companies considered introducing IDEO's methods to reform the organization and to generate new projects. The IDEO method was not detailed enough and lacked clarity. The lack of a clearly articulated design centered methodology will deter enterprises from adopting or investing in such methodologies as seen in this example.

- **BrainStore's Idea Machine Process**

BrainStore is based on a Swiss foundation with their primary business consisting of creative workshops and consulting. They have developed a process called "IdeaMachine" that anyone can participate in and enable them to generate ideas consistently. IdeaMachine says that in order to acquire good ideas, it is important to have various types of members on board. In most cases, 1/3 are teenagers, 1/3 are the ones using ideas and 1/3 are the ones who will actualize an idea. They present a systemized method for defining the problem, forming teams and delegating roles, using various physical ways to get inspiration, extracting an idea from inspiration, visualizing the process, and idea selection. [11] Idea Machine also provides web-based software called "IdeaFactory" which anyone can use regardless of time and place, so quality ideas can be produced at anytime. In order for enterprises to accept Design Thinking Methodology, the methodology would have to be processed and modulated and it has to be developed so that anyone can learn them quickly and use them in the short term.



IdeaMachine Process　　Idea Factory S/W

Figure. 7 BrainStore Process and Software

- **Everyday Engineering Methodology**

The Everyday Engineering methodology from IDEO and Andrew Burroughs gives a concrete example that makes Design Thinking possible and turning observations into concepts. At its core it is a way to build up your six senses and introduces ways to build insight and perceive new value. [12] Experience is said to be store in the front section of frontal lobe of the brain. The idea of Everyday Engineering is to enable people to store experience and to be able to access that information when faced with day-to-day stimulus. To train this insight, it

is necessary to build up the ability to observe and confront new experiences that eventually results in the gain of insight when new and old experiences combine. Everyday Engineering guides an individual in developing a habit of observing daily life and comparing it to past experience to generate new concepts. The manner in which these concepts and insights are converted into something tangible is not clear and therefore is difficult to use.

- **Dan Roam's Idea Visualization Methodology**

Dan Roam's *The back of the Napkin* suggests that the way to communicate effectively is by drawing our ideas and thoughts. The concept of visualized thinking can be broken down into four parts, "Look at the Ideas through eyes", "Find the Idea", "Improve your Idea" and "Sell your Idea." Roam introduces the SQVID technique, which has 6 principles to look at ideas and to develop it with ones heart. Roam explains how one can communicate one's ideas to others.[12]

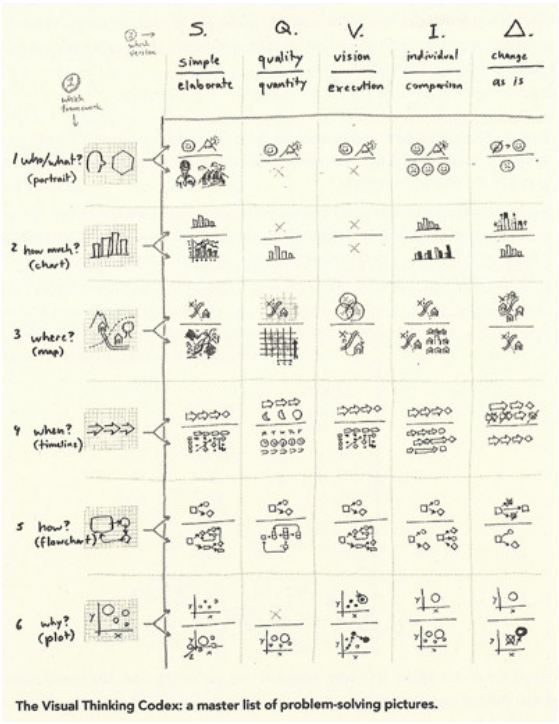


Figure.8 SQVID - Dan Roam's *The Back of the Napkin*

4. Conclusions

4.1 Research Results

Technology centered processes like the DIY and Open Source movements have made it easy for anyone to participate and share information. It also creates an environment conducive to becoming acquainted with technology. Through sharing, a person gets to meet and learn new things in a social way. This has helped people create inspiration and acquire knowledge by, learning through making. This will allow enterprises to develop ideas that can overcome the limitations of technology and make it possible for them to create prototypes to run tests on. Changes in the prototyping process will reduce fear and pressure while allowing users to participate easily with no restrictions. As a result, participants will gain confidence by learning from shared information in easy steps while using advanced technology.

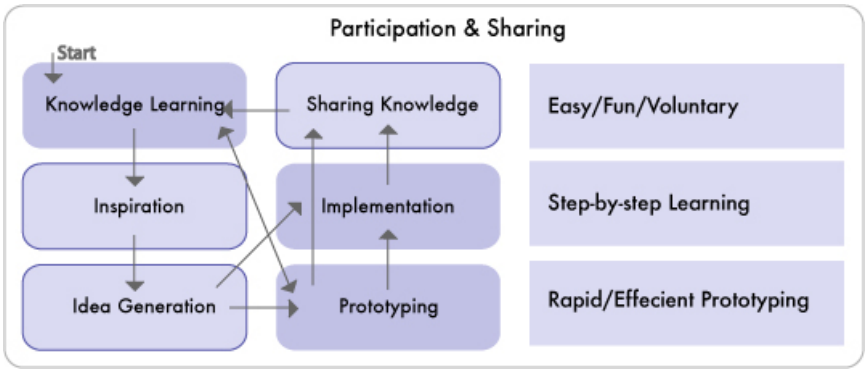


Figure.9 Technology Solutions Diagram

A design solution that is presented as a concrete and practical methodology that incorporates design thinking and user centric design processes will be ideal for adoption by enterprises. To make Design Thinking more concrete and palatable to enterprises, the ideas and concepts must be illustrated precisely while being able to yield ideas and prototypes. This process can be systematically made into a generalized modular system that will allow anyone in the company to come up with and to contribute an idea.

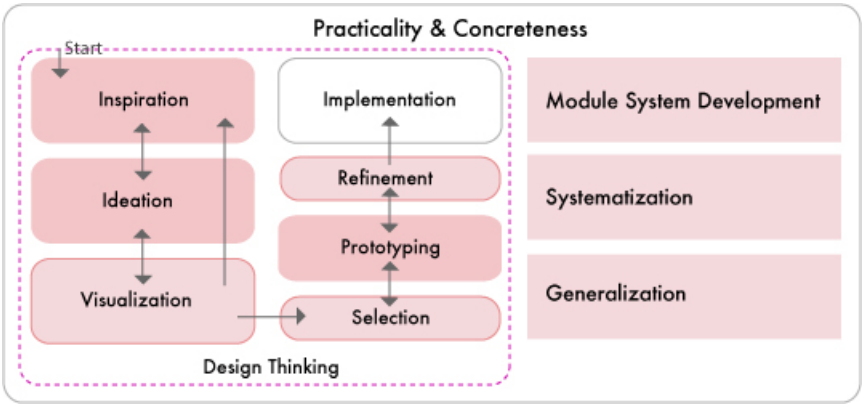


Figure.10 Design Solutions Diagram

In conclusion, combining design and technology based methods will allow all divisions to field ideas, not just engineers. For this to happen, it is necessary to make technology accessible through the dissemination of information and direct participation. Combining design and technology based methods will foster a culture of free engagement, learning and sharing.

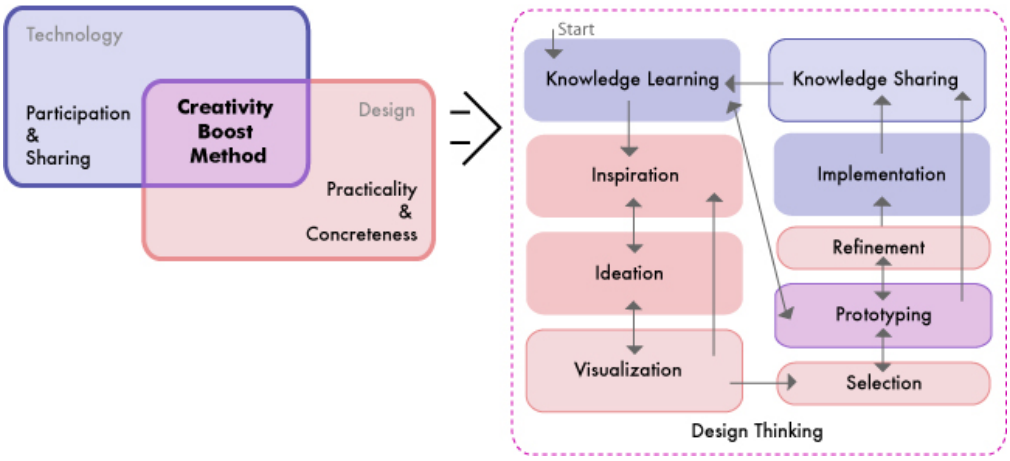


Figure.11 Ideal Solution

4.2 Future Works

Hereafter as a research subject, there should be a case study of people within technology fields and people within design fields that investigates respective creative concept methodologies. In order to do this, two research groups will be needed: one group that focuses on technology and the other that focuses on design. Comparisons of the thought processes used by each discipline will be made and alternative approaches will be sought. The next step woud be to develop a tool through which non-specialists could quickly learn technology ("knowledge learning" in figure. 11) and eventually produce tangible results in the form of prototypes. Future research would develop a system that provides a learning environment based on sharing ideas and information. This would provide people with inspirational ideas while also utilizing Design Thinking to develop ideas rooted in actual experience. In addition, research would aim to develop a systematic model of the design process. By observing the users using these tools, systems, and processes, work towards an ideal creative model.

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